

BIOLOGICAL OPINION

Description of the proposed action

The Feasibility Report summarizes the COE's cooperative, cost-shared feasibility study on beach erosion and storm damage problems of the Atlantic Ocean shoreline along the southeast coast of Florida. The COE proposes to construct 27 shore protection projects consisting of beach nourishment, beach renourishment and sand transfer (See Table I). These project segments span 93 kilometers of shoreline in Palm Beach, Broward and Dade Counties. Thirteen of these 27 projects have been previously authorized as Civil Works projects. Fourteen of the projects will require Congressional authorization.

Table I. Project Plans Proposed in the Coast of Florida Study, Region III

Project Name	Project Type	Status
Bakers Haulover Inlet	0.1 Km Sand Transfer	New Project
Bal Harbour, Surfside, Miami Beach	14.3 Km Renourishment	Authorized Project
Boca Raton	2.3 Km Renourishment	Authorized Project
Dania Beach	1.0 Km Renourishment	New Project
Deerfield Beach	7.2 Km Renourishment	New Project
Delray Beach	4.3 Km Renourishment	Authorized Project
Fort Lauderdale	1.3 Km Renourishment	New Project
Golden Beach	1.8 Km Renourishment	New Project
Government Cut	0.3 Km Jetty Tightening	New Project
Highland Beach	5.1 Km Renourishment	New Project
Hillsboro Inlet	0.3 Km Sand Trap	New Project
Hollywood/Hallandale 4.28	8.5 Km Renourishment	Authorized
John U. Lloyd 2.29 km	3.7 Km Renourishment	Authorized
Jupiter/Juno Beach	4.8 Km Renourishment	Authorized Project
Key Biscayne	5.2 Km Renourishment	Authorized Project
Lake Worth Inlet	0.9 Km Sand Transfer	New Project
N. Palm Beach Island	3.0 Km Renourishment	Authorized Project
Ocean Ridge	2.4 Km Renourishment	Authorized Project
Palm Beach Island	4.3 Km Renourishment	Authorized Project
Pompano/Lauderdale by the Sea - 5.29 km	8.5 Km Renourishment - 5.29 km	Authorized
Port Everglades	.3 Km Sand Transfer	New Project
Port Everglades	Spur and Breakwater	New Project
Riviera Beach	1.7 Km Groin or Breakwater	New Project

Table I. Project Plans Proposed in the Coast of Florida Study, Region III

Riviera Beach	2.7 Km Dune	New Project
S. Palm Beach Island	4.8 Km Renourishment	Authorized Project
So. Lake Worth Inlet	0.4 Km Sand Transfer	New Project
Sunny Isles (Hawlover Beach)	4.0 Km Renourishment (2.5 miles)	Authorized Project

Action Area

The action area for this Biological Opinion includes all shoreline where fill is proposed to be deposited or removed for transfer across an inlet, which amounts to 36 km of shoreline in Palm Beach County, 34 km in Broward County and 26.6 km in Dade County.

The COE has determined that the planned actions in the Coast of Florida Study, Region III may affect sea turtle nesting. Our records indicate that the threatened loggerhead sea turtle (*Caretta caretta*), as well as the endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*) and hawksbill sea turtle (*Eretmochelys imbricata*), nest on the beaches in Palm Beach, Broward, and Dade Counties.

Status of the species

The FWS has responsibility for protecting sea turtles when they come ashore to nest. The National Marine Fisheries Service (NMFS) has responsibility over sea turtles in the marine environment. In applying the jeopardy standard under the ESA, the FWS has determined that sea turtle species occurring in the U.S. represent populations that qualify for separate consideration under section 7 of the ESA. Therefore, even though sea turtles are wide-ranging and have distributions outside the U.S., the FWS only considers the U.S. populations of sea turtles when making jeopardy or no jeopardy determinations under section 7.

The reproductive strategy of sea turtles involves producing large numbers of offspring to compensate for the high natural mortality through their initial years of life. For at least two decades, several human-caused mortality factors have contributed to the decline of sea turtle populations along the Atlantic coast and in the Gulf of Mexico (National Research Council 1990a). These factors include commercial over-utilization of eggs and turtles, incidental catches in commercial fishing operations, degradation of nesting habitat by coastal development, and marine pollution and debris. Therefore, human activities that affect the behavior and/or survivability of turtles on the remaining nesting beaches, particularly the few high density nesting beaches, could seriously reduce our ability to protect sea turtles.

Loggerhead sea turtle

The loggerhead sea turtle, which was listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984). Total estimated nesting in the southeastern U.S. is approximately 50,000 to 70,000 nests per year (NMFS and FWS 1991b).

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to the population that nests on islands in the Arabian Sea off of Oman (Ross 1982, Ehrhart 1989, NMFS and FWS 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (NMFS and FWS 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward (NMFS and FWS 1991b).

Recent genetic analyses using restriction fragment analysis and direct sequencing of mitochondrial DNA have been employed to resolve management units among loggerhead nesting cohorts of the southeastern U.S. (Bowen *et al.* 1993; B.W. Bowen, University of Florida, Gainesville, in litt., November 17, 1994, and October 26, 1995). Assays of nest samples from North Carolina to the Florida Panhandle have identified three genetically distinct nesting populations: (1) northern nesting population - Hatteras, North Carolina, to Cape Canaveral, Florida; (2) South Florida nesting population - Cape Canaveral to Naples, Florida; and (3) Florida Panhandle nesting population - Eglin Air Force Base and the beaches around Panama City, Florida. These data indicate that gene flow between the three regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting population (Bowen *et al.* 1993, B.W. Bowen, University of Florida, Gainesville, in litt., October 26, 1995).

Green sea turtle

The green sea turtle, which was listed as an endangered species on July 28, 1978 (43 FR 32800), has a worldwide distribution in tropical and subtropical waters. Major green sea turtle nesting colonies in the Atlantic Ocean occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Breeding populations of the green sea turtle in Florida and along the Pacific coast of Mexico are listed as endangered; all other populations are listed as threatened.

Within the U.S., green sea turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and FWS 1991a). Nesting also has been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (FDEP, unpublished data).

Green sea turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpub. data) and they nest sporadically in North Carolina (North Carolina Wildlife Resources Commission, unpublished data). No green sea turtle nesting has been documented in South Carolina (S. Murphy, South Carolina Department of Natural Resources, in litt., November 8, 1995). Unconfirmed nesting of green sea turtles in Alabama has been reported (R. Dailey, Bon Secour National Wildlife Refuge, personal communication).

Leatherback sea turtle

The leatherback sea turtle, which was listed as an endangered species on June 2, 1970 (35 FR 8491), is found in the Atlantic, Pacific and Indian Oceans. Leatherback sea turtles have been recorded as far north as Labrador and Alaska and as far south as Chile and the Cape of Good Hope. Nesting grounds are distributed circumglobally, with the Pacific Coast of Mexico supporting the world's largest known

concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (NMFS and FWS 1992, National Research Council 1990a).

Leatherback sea turtles regularly nest in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (NMFS and FWS 1992). Leatherback turtles have been known to nest in Georgia and South Carolina, but only on rare occasions (Georgia and South Carolina Departments of Natural Resources, unpublished data). Leatherback nesting also has been reported on the west coast of Florida on St. Vincent National Wildlife Refuge (LeBuff 1990), St. Joseph Peninsula State Park (FDEP, unpublished data), and St. George Island (T. Lewis, St. Vincent National Wildlife Refuge, personal communication); a taise crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Hawksbill sea turtle

The hawksbill sea turtle, which was listed as an endangered species on June 2, 1970 (35 FR 8491), is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. Within the continental U.S., hawksbill sea turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys in Monroe County (Meylan 1992, Meylan *et al.* 1995). Hawksbill tracks are difficult to differentiate from those of loggerheads and may not be recognized by surveyors. Therefore, surveys in Florida probably underestimate actual hawksbill nesting numbers (Meylan *et al.* 1995). In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (NMFS and FWS 1993).

ENVIRONMENTAL BASELINE

Status of the species in the action area

A. Nesting within Region III compared to nesting statewide

The following discussion of sea turtle nesting within Palm Beach, Broward, and Dade Counties, as well as comparisons to statewide nesting trends, was derived from data provided by Meylan *et al.* (1995) and Meylan (unpublished data). Meylan *et al.* (1995) tabulates the results of nesting surveys throughout Florida between 1979 and 1992. Unpublished data are available for the 1993 and 1994 nesting seasons.

Approximately 25 percent of Florida's sea turtle nesting occurs annually in the tri-county area known as Region III. During the nesting seasons from 1979 to 1992, loggerhead sea turtles laid 21.8 percent of their nests within Region III; green sea turtles laid 28.4 percent; and leatherbacks laid 34.7 percent. Hawksbill sea turtles reportedly laid 64 percent of their nests on Region III beaches; however, total nesting activity was low (11 nests state-wide) and this high percentage could be due to factors other than regional nesting preference.

Statewide and within Region III of the Coast of Florida Study, loggerhead sea turtle nests account for the vast majority of reported nesting (97.9 and 95.1 percent, respectively, from 1979 to 1992). During this same period, green sea turtle nests amounted to 0.2 percent of nesting state-wide and 4.2 percent within Region III. Nesting totals for each species differ substantially. From 1988 to 1992, while survey efforts remained relatively constant, the total number of reported loggerhead nests state-wide fluctuated between

37,242 and 68,614. Green sea turtle nests were reported to fluctuate between 455 and 2,509 during the same period. While totals differ, the distributions of loggerhead and green sea turtle nests follow a similar pattern on the east coast of Florida.

The most nesting activity by both species occurred outside of the action area to the north in Brevard County. Loggerhead and green sea turtles laid 39.4 percent and 39.5 percent, respectively, of their nests in Brevard County. Palm Beach County supported the second highest percentage of nests for both species with 17.8 percent of loggerhead nests and 23.1 percent of green sea turtle nests.

Broward County was sixth in importance as a nesting location for both species. Loggerhead sea turtles laid 3.4 percent of their nests here between 1979 and 1982 and green sea turtles laid 5.0 percent of their nests in Broward County during the same period. Dade County had a small but significant proportion of nests (0.6 for loggerheads and 0.3 for greens) from 1979 to 1992.

Between 1988 and 1992, annual reported leatherback sea turtle nests varied between 98 and 188 state-wide. The distribution of these nests differs from the loggerhead and green sea turtle nests discussed above. Leatherback nests have a center of distribution at Palm Beach County which supports more than half (50.1 percent) of the total nests reported state-wide. To the north, Martin and St. Lucie County beaches have been the site of 27.7 percent and 13.2 percent of leatherback nests, respectively. South of Palm Beach County, the number of leatherback nests declines more sharply. Broward County supported 3.0 percent of leatherback nesting and Dade County supported 1.6 percent.

The hawksbill sea turtles nest so rarely in Florida (only 11 nests reported state-wide from 1979 to 1992) that no distinct pattern of distribution is apparent. However, the majority (7) of those reported nestings have occurred within the Region III area. One hawksbill nest was reported from Palm Beach County in 1985 and two in 1992, one in Broward County in 1986, and one in 1981 and two in 1990 in Dade County.

B. Nesting within Region III

The average number of nests annually of each species within each Region III county are shown in Table 2. These data show that Palm Beach County is clearly the most important nesting location within the region for the endangered leatherback and green sea turtles. Less evident from Table 2 is the fact that as the total number of nests for these species declines from north to south, so too does the percentage that these nests contribute to total nesting activity. Green sea turtles lay 4.3 percent of total nests in Palm Beach and Broward Counties, but only 0.5 percent of the total in Dade County. Similarly, leatherback nests constitute 0.8 percent of the total in Palm Beach County but only 0.4 and 0.5 percent in Broward and Dade Counties, respectively.

Table 2. Average annual number of nests by county from 1992 to 1994

	Loggerhead	Green	Leatherback	Hawksbill
Palm Beach	12,133	544	99	1
Broward	2,226	101	11	0
Dade	401	2	2	0

C. Nesting activity trends in Region III

Throughout the state, the number of sea turtle nests (all-species) per kilometer surveyed from 1979 to 1992 appears to have increased slightly. Loggerhead nest numbers vary enough from year to year to prevent Meylan *et al.* (1995) from drawing a firm conclusion that loggerhead nesting is increasing (see Figure 1). Kilometers surveyed increased as the study progressed, thus, the figures become increasingly reliable. It appears that loggerhead nesting activity could be on a four year cycle. Figure 1 shows peaks in nesting density for 1982, 1986, and 1990. Similarly, green sea turtle nesting exhibits a two year cycle in activity.

A trend toward increasing loggerhead nesting within Region III appears more evident as seen in Figure 2. The contribution from each county to each year's loggerhead nesting activity can be approximated by reviewing Table 2. All counties have a similar trend.

Dissimilar trends in green sea turtle nesting among Palm Beach, Broward, and Dade Counties occurred from 1979 to 1994. Nesting activity for each year by county is shown in Figure 3.

The figure above shows a pronounced increase in green sea turtle nesting in Palm Beach County from 1990 to 1994. The phenomenon of higher nesting activity in alternating years can easily be seen in the years 1990, 1992, and 1994. This pattern can also be seen in the Broward County data. The trend toward increasing green sea turtle nesting activity over the long term is also clear from the figure. Dade County, however, shows a decrease in reported green sea turtle nesting per kilometer. Except in 1980, the number of nests per kilometer in Dade County is low, which could be due to random fluctuations in nesting activity. Meylan *et al.* (1995) report that an increase in green sea turtle nesting has been observed statewide. We do not know the reason for this increase is unknown and regard it with cautious optimism.

Figure 1: Average number of loggerhead nests per kilometer surveyed in Florida from 1979 to 1992

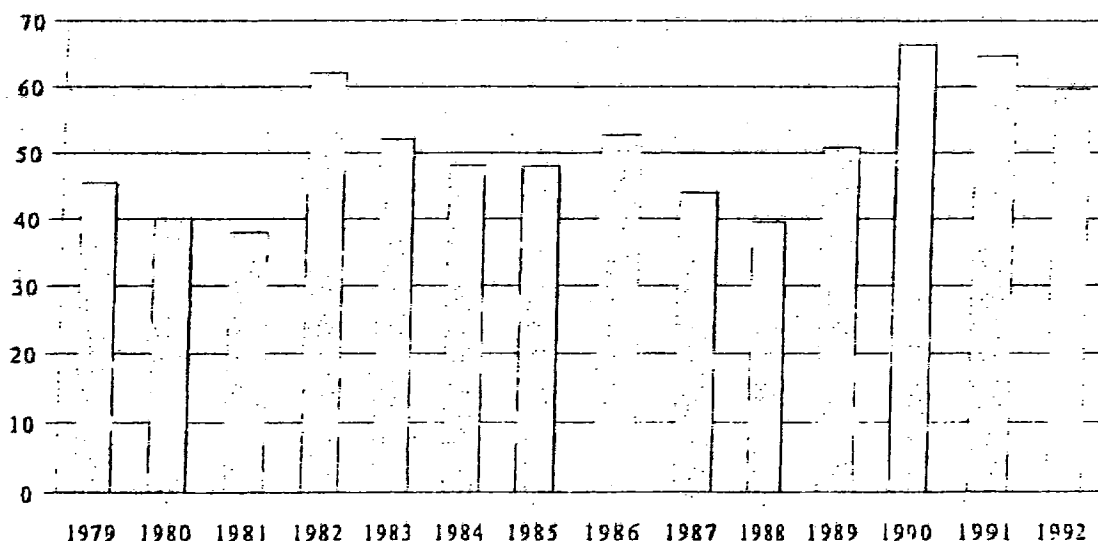


Figure 3. Green sea turtle nesting per kilometer surveyed for Dade, Broward and Palm Beach Counties, 1979 to 1994

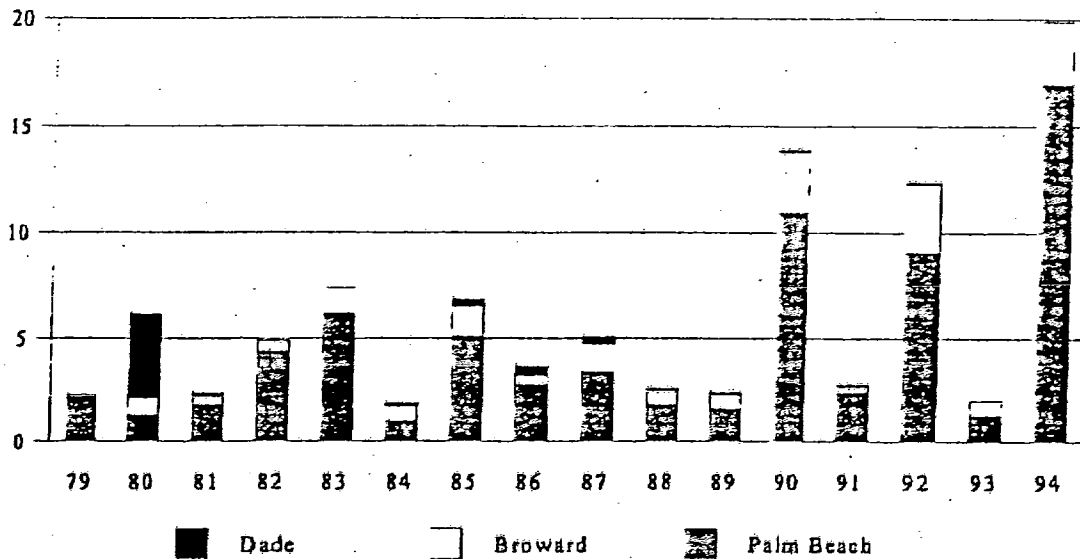
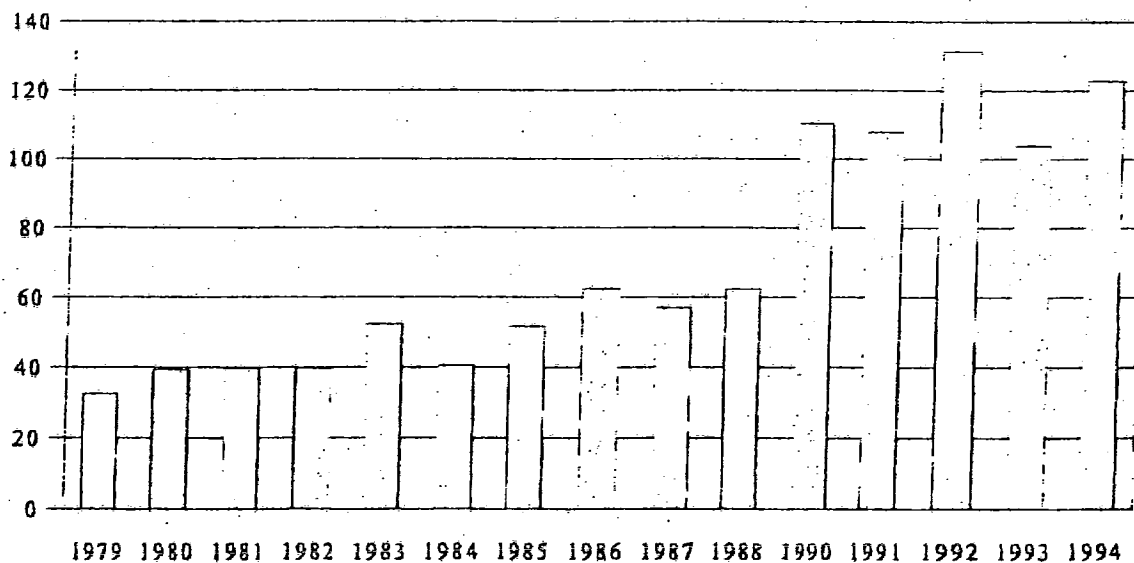


Figure 2. Average number of loggerhead nests per kilometer surveyed in Palm Beach, Broward, and Dade Counties, Florida, from 1979 to 1994



Leatherback nesting has fluctuated widely during the survey period between 1979 and 1994. In Palm Beach County, where the most leatherback nesting occurs, the reported nesting densities for the period vary from 0.3 nests per kilometer in 1980 to 2.3 nests per kilometer in 1994. A peak in nesting density occurred in 1983 when 1.8 nests per kilometer were reported. From 1979 to 1994, 735 leatherback nests were reported from Palm Beach County; Broward County reported 109 nests and Dade County reported 15 leatherback nests.

In Broward County, there is not a clear trend in leatherback nesting activity. Nests per kilometer ranged from 0.0 in 1990 to 0.7 in 1987. Nesting by leatherbacks in Dade County is too low to exhibit discernable trends.

No trends in nesting activity are evident in nesting frequency by the hawksbill sea turtle. As previously stated, however, seven hawksbill nests out of the 11 reported statewide from 1979 to 1994 were from Region III counties. Underreporting of hawksbill nests undoubtedly occurs as a result of their extended nesting season. Most seasonal beach surveys end in the late summer or early fall. Thus, hawksbill nests laid in late fall or early winter would not be included in the survey. Underreporting of leatherback nesting also occurs because leatherbacks begin nesting prior to the beginning of annual beach surveys. The nesting and hatching seasons for each species within Region III are given on the following page.

Species	Nesting and Hatching Dates
Loggerhead sea turtle	March 15 to November 30
Green sea turtle	May 1 to November 30
Leatherback sea turtle	February 15 to November 15
Hawksbill sea turtle	June 1 to December 31

D. Nest relocation

With few exceptions, most sea turtle nests are relocated from the beaches where they are laid in Broward and Dade Counties. This is done to protect the eggs and hatchlings from harm due to the high degree of human activity on these beaches. Most areas within these two counties are densely developed with multi-family residential (condominiums) and resort (hotels) development. The Atlantic shoreline at Golden Beach, Dade County and Hillsboro Beach, Broward County is developed with single-family residential development; public access and lighting are minimized. In these locations, nests are left *in situ*. Many of the Broward County nests are relocated to Hillsboro Beach. Nests are also left *in situ* at John U. Lloyd State Park, Broward County.

Both Broward and Dade Counties have been successful in hatching young loggerhead and green sea turtles from relocated nests. Broward County (1995) reports a 72.0 percent rate of hatching success for 1687 relocated nests. The 419 nests left *in situ* and monitored had a 76.6 percent hatching success rate. A significant fraction of the relocated nests (14) were laid by green turtles. Green turtle egg viability was greatly reduced by relocation. Only 55.6 percent of relocated green turtle eggs hatched while 76.1 percent of *in situ* green turtle eggs hatched successfully. Results in Dade County were similar. For the 326 relocated loggerhead nests, there was a 79.3 percent successful hatch rate. For the 29 *in situ* nests, the rate of successful hatching was 73.3 percent (Steve Blair, personal communication).

E. Nesting activity within each project area

All of the areas proposed for renourishment include some suitable nesting habitat. However, the proposed projects will not be constructed for many years and the suitability of each area for sea turtle nesting will likely change in this timeframe. Thus, the FWS will address the effect of individual projects on sea turtle nesting within each project area in later biological opinions.

EFFECTS OF THE PROPOSED ACTION

Since 1988, approximately 15 miles of shoreline have been renourished in Region III. These previously authorized projects have had a substantial effect on sea turtle nesting. The new proposed projects would

add to these effects by increasing incidental take due to nest relocation during construction, through missed nests, and through changes in the nesting environment after project construction. Conversely, nesting habitat within Region III will be increased over that which would exist without beach nourishment and renourishment.

A. Direct effects

Although beach nourishment may increase the potential nesting area, sea turtles may be adversely affected if protective measures are not incorporated into project planning and implementation. Placement of sand on an eroded section of beach or an existing beach, in and of itself, is not likely to provide suitable nesting habitat for sea turtles.

Nourishment and sand transfer during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of offspring from human-caused mortality and may significantly affect the long-term survival of the species. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtles through disruption of adult nesting activity and by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program would reduce these effects, nests may be inadvertently missed or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Even under the best conditions, about seven percent of the nests can be missed by experienced turtle nest surveyors (Schroeder 1994).

1. Nest relocation

Besides the potential for missing nests during a relocation program, there is a potential for eggs to be damaged by their movement or for unknown biological mechanisms to be affected. Nest relocation can have adverse effects on incubation temperature (hence, sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Relocating nests into sand deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard *et al.* 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard *et al.* 1985), hatchling size (Packard *et al.* 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard *et al.* 1988), and locomotory ability of hatchlings (Miller *et al.* 1987).

FIDEP has noted significant variations in comparing hatching success and emergence success between *in situ* and relocated nests (unpublished data). In a 1994 study, Meylan (unpublished data) found variations of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida. Hatching success was lower for relocated nests in five of seven cases with an average decrease for all seven sites of 5.01 percent (16.31 percent decrease \leftrightarrow 7.19 percent increase). Emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (23.36 percent decrease \leftrightarrow 3.6 percent decrease).

A final concern with nest relocation is that it may concentrate eggs in an area resulting in a greater susceptibility to catastrophic events. Hatchlings released from concentrated areas may be subject to greater predation rates from both land and marine predators, who have adapted to concentrate their foraging efforts.

2. Equipment

The placement of pipelines and the use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. They can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure.

3. Changes in the physical environment

Beach nourishment may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand (Nelson and Dickerson 1988a). These changes could result in adverse effects on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987, Nelson 1988).

4. Compaction

Beach compaction and unnatural beach profiles that may result from beach nourishment activities could adversely affect sea turtles regardless of the timing of the projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988a). Significant reductions in nesting success have been documented on severely compacted nourished beaches (Fleremeyer 1980, Raymond 1984, Nelson and Dickerson 1987, Nelson *et al.* 1987). Increased false crawls result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests, again, causing increased physiological stress to the animals (Nelson and Dickerson 1988c). These effects can be minimized by using suitable sand and by tilling the beach after nourishment. Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

5. Escarpments

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984, Nelson *et al.* 1987). These escarpments can hamper or prevent access to nesting sites. Female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of the escarpments which often results in failure of nests due to tidal inundation). This effect can be minimized by leveling the beach prior to the nesting season.

6. Sediment color

A change in sediment color on a beach could change the natural incubation temperatures of nests in an area which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments must resemble the natural beach sand in the area. Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the time frame for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

7. Disorientation

Another effect to sea turtles is disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchlings from artificial lighting. Visual cues are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). Artificial beachfront lighting is a well documented cause of hatchling disorientation and misorientation on nesting beaches (Philbosian 1976, Mann 1977, FDEP unpublished data). In addition, research has also documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992). Therefore, construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, disorient females trying to return to the surf after a nesting event, and disorient and misorient emergent hatchlings from adjacent non-project beaches. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to predatory fishes that are also attracted to the barge lights. This effect could be reduced by using the minimum amount of light necessary, require shielding or use low pressure sodium lighting during project construction.

B. Indirect effects

Future erosion of nesting beaches is a potential indirect effect of nourishment projects on sea turtles. Dredging sand offshore from a project area has the potential to cause erosion of the newly created beach or other areas on the same or adjacent beaches by creating a sand sink. The remainder of the beach system responds to this sand sink by providing sand from the beach in an attempt to reestablish equilibrium (National Research Council 1990b).

C. Cumulative effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Construction of all of the beach segments proposed in the Coast of Florida Study would have significant cumulative effects on sea turtle nesting in Region III. Approximately 60 miles of shoreline are proposed for construction out of a total of 93 miles. However, not all of the proposed project segments will be built at or near the same time. According to past construction schedules, four or five project segments could be constructed in a single year. As these constructed segments erode, other segments will be constructed. This cycle of erosion and renourishment will be repeated at various locations within the region resulting in little net gain of dry beach throughout the region. Some of the proposed projects may never be constructed. The net cumulative effect will be the additive incidental take of sea turtle nests and eggs due to relocation and burial of missed nests due to repetitive construction of beach projects. However, the annual rate of this incidental take, with precautions, should be low enough to remain within limits that are acceptable to the FWS.

CONCLUSION

After reviewing the current status of the loggerhead, green, leatherback and hawksbill sea turtles, the environmental baseline for the action area, the effects of the proposed beach nourishments, and the cumulative effects, it is the FWS' biological opinion that the planned actions in the Coast of Florida Study, Region III, as proposed, are not likely to jeopardize the continued existence of the sea turtles listed above.

No critical habitat has been designated for the loggerhead or green sea turtles. Critical habitat has been designated for leatherback sea turtles (St. Croix, U.S. Virgin Islands) and for hawksbill sea turtles (Mona, Culebrita, and Culebra Islands, Puerto Rico). These proposed actions do not affect those areas, thus, there is no effect on designated critical habitat for these two species.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered by this incidental take statement. If the COE (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or extent of incidental take

Broward County and Palm Beach County (excluding sand transfer plants)

The FWS has reviewed the biological information and other information relevant to this action. Based on this review, incidental take is anticipated for all sea turtle nests that may be constructed and eggs that may be deposited from March 1 through April 30 and from September 1 through September 30 and missed by a nest survey and egg relocation program within the boundaries of the seventeen proposed fill projects. Incidental take is also anticipated for all sea turtle nests deposited from October 1 through February 28 (or 29 as applicable) when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project. Without the prescribed precautions, this take could equal 250 missed nests and 27,000 eggs rendered inviable through relocation annually.

Dade County and Palm Beach County sand transfer plants

The FWS has reviewed the biological information and other information relevant to this action. Based on this review, incidental take is anticipated for all sea turtle nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed projects. Incidental take is also anticipated for all sea turtle nests deposited during the period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project.

Effect of the take

In the accompanying biological opinion, the FWS determined that this level of anticipated take is not likely to result in jeopardy to the species.

Reasonable and prudent measures

Broward County and Palm Beach County (excluding sand transfer plants)

The FWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of loggerhead, green, leatherback and hawksbill sea turtles in Broward and Palm Beach Counties.

1. Only beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence shall be used on the project site.
2. Beach nourishment activities shall not occur from May 1 through October 31, the period of peak sea turtle egg laying and egg hatching, to reduce the possibility of sea turtle nest burial or crushing of eggs.
3. If the beach nourishment project will be conducted during the period from March 1 through April 30, surveys for early nesting sea turtles shall be conducted. If these surveys find nests in a beach nourishment area, the eggs of those nests shall be relocated.
4. If the beach nourishment project will be conducted during the period from November 1 through November 30, surveys for late nesting sea turtles shall be conducted. If these surveys find nests in a beach nourishment area, the eggs of those nests shall be relocated.
5. Immediately after completing a beach nourishment project and prior to the next three nesting seasons, beach compaction shall be monitored and tilling shall be conducted by March 1, as required, to reduce the likelihood of affecting sea turtle nesting and hatching activities. The March 1 deadline is required to reduce adverse effects to leatherbacks that nest in greater frequency along the South Atlantic coast of Florida than elsewhere in the contiguous United States.
6. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, monitoring shall be conducted to determine if escarpments are present and escarpments shall be leveled as required to reduce the likelihood of affecting sea turtle nesting and hatching activities.

7. The COE shall ensure that contractors doing the beach nourishment work fully understand the sea turtle protection measures detailed in this incidental take statement.
8. During the early and late portions of the nesting season, construction equipment and pipes shall be stored in a manner that will minimize effects to sea turtles to the maximum extent practicable.
9. During the early and late portions of the nesting season, lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles.

Dade County and all sand transfer plants

The FWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of loggerhead, green, leatherback, and hawksbill sea turtles in Dade County and at the site of all sand transfers.

1. Only beach-quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence shall be used on the project site.
2. If a beach nourishment project or sand transfer will be conducted during the sea turtle nesting season, surveys for nesting sea turtles shall be conducted. If these surveys find nests in the beach nourishment or sand transfer areas, including the area from which sand will be transferred, the eggs of those nests shall be relocated.
3. Immediately after completion of a nourishment or transfer of sand and prior to the next three nesting seasons, beach compaction shall be monitored and tilling shall be conducted, as required, to reduce the likelihood of affecting sea turtle nesting and hatching activities.
4. Immediately after completion of the beach nourishment or transfer of sand and prior to the next three nesting seasons, monitoring shall be conducted to determine if escarpments are present and escarpments shall be leveled as required to reduce the likelihood of affecting sea turtle nesting and hatching activities.
5. The COE shall ensure that contractors doing the beach nourishment or transfer work fully understand the sea turtle protection measures detailed in this incidental take statement.
6. During the sea turtle nesting season, construction equipment and pipes shall be stored in a manner that will minimize effects to sea turtles to the maximum extent practicable.
7. During the sea turtle nesting season, lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

Broward County and Palm Beach County (excluding sand transfer plants)

1. Fill material placed on the beach shall be sand that is similar to that already existing at the beach site in both coloration and grain size. All such fill material shall be free of construction debris, rocks, or other foreign matter and shall not contain, on average, greater than 10 percent fines (i.e., silt and clay) passing a No. 200 sieve and shall not contain, on average, greater than 5 percent coarse gravel or cobbles, exclusive of shell material retained by a No. 4 sieve.
2. Beach nourishment shall be started after October 31 and be completed before May 1. During the May 1 through October 31 period, no construction equipment or pipes shall be stored on the beach.
3. If the beach nourishment project will be conducted during the period from March 1 through April 30, daily early morning surveys for sea turtle nests shall be conducted within the period from March 1 through April 30 that the project is being conducted, and eggs shall be relocated per the following requirements.
 - a. Nest surveys and egg relocations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures. Surveyors shall have a valid FDEP permit. Nest surveys shall be conducted daily between sunrise and 9 a.m. Surveys shall be performed in such a manner that ensures that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.
 - b. Only those nests that may be affected by construction activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zone shall be clearly marked, and all mechanical equipment shall avoid nests by at least 10 feet.
4. If the beach nourishment project will be conducted during the period from November 1 through November 30, daily early morning surveys for sea turtle nests shall be conducted 65 days prior to project initiation and continue through September 30, and eggs shall be relocated in accordance with the requirements outlined above.
5. Immediately after completion of the beach nourishment project and prior to March 1 for three subsequent years, sand compaction shall be monitored in the area of restoration in accordance with protocol agreed to by the FWS, the FDEP, and the applicant. At a minimum, the protocol provided under 5a and 5b (below) shall be followed. If required, the area shall be tilled to a depth of 36 inches. All tilling activity must be completed prior to March 1. A report on the results of compaction monitoring shall be submitted to the FWS prior to any tilling actions being taken. An annual summary of compaction surveys and the actions taken shall be submitted to the FWS. This condition shall be evaluated annually and may be modified, if necessary, to address sand compaction problems identified during the previous year.
 - a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed

in this area); one station shall be midway between the dune line and the high water line (normal wrack line); and one station shall be located just landward of the high water line. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 27 values for each transect line, and the final nine averaged compaction values.

- b. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area shall be tilled prior to March 1. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the FWS shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling shall not be required.
6. Visual surveys for escarpments along the project area shall be made immediately after completion of the beach nourishment project and prior to March 1 for three subsequent years. Results of the surveys shall be submitted to the FWS prior to any action being taken. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled to the natural beach contour by March 1. The FWS shall be contacted immediately if subsequent reformation of escarpments that can interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the FWS will provide a brief written authorization that describes methods to be used to reduce the likelihood of affecting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the FWS.
7. The COE shall arrange a meeting between representatives of the contractor, the FWS, the FDEP, and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.
8. From March 1 through April 30 and November 1 through November 30, staging areas for construction equipment shall be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes shall be off the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to affect the least amount of nesting habitat and shall likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

9. From March 1 through April 30 and November 1 through November 30, all on-beach lighting associated with the project shall be limited to the immediate area of active construction only. Such lighting shall be shielded low pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters should be placed over vehicle headlights (i.e., bulldozers, front-end loaders). Lighting on offshore equipment shall be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.
10. A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to the South Florida Ecosystem Office within 60 days of completion of the proposed work for each year when activity has occurred. Each report shall include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of hatcheries, nest survey and relocation results, and hatching success of nests.
11. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project should be notified so the eggs can be moved to a suitable relocation site.
12. Upon locating a dead, injured, or sick threatened or endangered sea turtle specimen, initial notification must be made to the FWS' Law Enforcement Office in Miami, Florida, at (305) 526-2789. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Dade County and all sand transfer plants

1. Material placed on the beaches shall be sand that is similar to that already existing at the beach site in both coloration and grain size. All such fill material shall be free of construction debris, rocks, or other foreign matter and shall generally not contain, on average, greater than 10 percent fines (i.e., silt and clay) passing a No. 200 sieve and shall not contain, on average, greater than 5 percent coarse gravel or cobbles, exclusive of shell material retained by a No. 4 sieve.
2. Daily early morning surveys shall be required if any portion of the beach nourishment project occurs during the period from April 1 to November 30. Nesting surveys shall be initiated 65 days prior to nourishment activities or by April 1, whichever is later. Nesting surveys shall continue through the end of the project or through September 30, whichever is earlier. If these surveys find nests in areas where they may be affected by construction activities, the eggs of those nests shall be relocated per the following requirements:
 - a. Nest surveys and egg relocations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures. Surveyors shall have a valid FDEP permit. Nest surveys shall be conducted daily between sunrise and 9 a.m. Surveys shall be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.

- b. Only those nests that may be affected by construction or sand transfer activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zone shall be clearly marked, and all mechanical equipment shall avoid nests by at least 10 feet.
3. Immediately after completion of the beach nourishment project or sand transfer and prior to April 1 for three subsequent years, sand compaction shall be monitored in the area of restoration in accordance with a protocol agreed to by the FWS, the FDEP, and the applicant. At a minimum, the protocol provided under 3a and 3b below shall be followed. If required, the area shall be tilled to a depth of 36 inches. All tilling activity must be completed prior to April 1. If the project is completed during the nesting season, tilling shall not be performed in areas where nests have been left in place or relocated. A report on the results of compaction monitoring shall be submitted to the FWS prior to any tilling actions being taken. An annual summary of compaction surveys and the actions taken shall be submitted to the FWS. This condition shall be evaluated annually and may be modified if necessary to address sand compaction problems identified during the previous year.
 - a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area); one station shall be midway between the dune line and the high water line (normal wrack line); and one station shall be located just landward of the high water line. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 27 values for each transect line, and the final nine averaged compaction values.
 - b. If the average value for any depth exceeds 500 psi for any two or more adjacent stations, then that area shall be tilled immediately prior to April 1. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Fish and Wildlife Service shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling shall not be required.
4. Visual surveys for escarpments along the project area shall be made immediately after completion of the beach nourishment project and prior to April 1, for three subsequent years. Results of the surveys shall be submitted to the FWS prior to any action being taken. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled to the natural beach contour by April 1. If the project is completed during the sea turtle nesting and hatching season, escarpments may be required to be leveled immediately, while protecting

nests that have been relocated or left in place. The FWS shall be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the FWS will provide a brief written authorization that describes methods to be used to reduce the likelihood of affecting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the FWS.

5. The COE shall arrange a meeting between representatives of the contractor, the FWS, the FDEP and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.
6. From April 1 to November 30, staging areas for construction equipment shall be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes shall be off the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to affect the least amount of nesting habitat and shall likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).
7. From April 1 to November 30, all on-beach lighting associated with the project shall be limited to the immediate area of active construction only. Such lighting shall be shielded low pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters should be placed over vehicle headlights (i.e., bulldozers, front-end loaders). Lighting on offshore equipment shall be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.
8. A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to the South Florida Ecosystem Office within 60 days of completion of the proposed work for each year when activity has occurred. Each report will include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of hatcheries, nest survey and relocation results, and hatching success of nests.
9. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project should be notified so the eggs can be moved to a suitable relocation site.
10. Upon locating a dead, injured, or sick threatened or endangered sea turtle specimen, initial notification must be made to the FWS' Law Enforcement Office in Miami, Florida, at (305) 526-2789. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or

threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, the FWS believes that no more than those sea turtle nests and eggs that may be missed by a nest survey and egg relocation program, or those laid during the period when an egg relocation program is not required, will be incidentally taken. The FWS estimates this annual take to be three nests which may be missed by surveyors and 270 eggs rendered inviable by relocation. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take represents new information requiring review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the FWS the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Palm Beach County and Broward County

1. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The FDEP's Bureau of Beaches and Coastal Systems can provide technical assistance on the specifications for design and implementation.
2. Surveys for nesting success of sea turtles should be continued for a minimum of three years following beach nourishment to determine whether sea turtle nesting success has been adversely affected.
3. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

Dade County

1. Construction activities for this project and similar future projects should be planned to take place outside the main part of the sea turtle nesting and hatching season.
2. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The FDEP's Bureau of Beaches and Coastal Systems can provide technical assistance on the specifications for design and implementation.
3. Surveys for nesting success of sea turtles should be continued for a minimum of three years following beach nourishment to determine whether sea turtle nesting success has been adversely affected.